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GRAPE VARIETIES FOR WINE PRODUCTION[1]

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ALTHOUGH CALIFORNIA WINERIES have utilized a considerable tonnage of raisin and table grapes since repeal of Prohibition, their preferred material is wine grapes. In this state there are now only 170,000 acres of such grapes, producing about 600,000 tons per year. The average annual winery crush (1937 to 1941) has exceeded 900,000 tons, but the annual crush of wine grapes has not exceeded 450,000; hence wine grapes have constituted approximately only 50 per cent of the total crush.[4] Should normal winery demands continue, the acreage of wine grapes could probably be expanded with profit. The grower is interested in planting varieties that produce well, but the consumer is concerned with securing a product of good quality.

Interest in wine-grape adaptation to the climatic regions of California has extended from the time of Agoston Haraszthy in 1860 to the present. From 1880 until Prohibition, the California Agricultural Experiment Station conducted detailed studies, first under Dean E. W. Hilgard, later under Professor F. T. Bioletti. Since Prohibition repeal the studies have been continued, and the present circular summarizes the best information available.

Table wines may be either sweet or dry. They contain less than 14.0 per cent of alcohol, and the dry types should have over 0.6 per cent acid. The sweet types contain 0.5 to 5.0 per cent sugar and appear balanced with only about 0.5 per cent acid. The best grapes for the standard dry types should not exceed 24° Balling nor have a must acidity of less than 0.65 per cent. The natural sweet types of table wines will require musts with a Balling degree of 24 to 28, because it is necessary to maintain residual sugar in them; yet their acidity should be about 0.60 per cent.

Dessert wines also may be either sweet or dry. They contain over 18.0 per cent alcohol. Since this concentration is not easily obtained by natural

[1] This publication summarizes the recommendations of the Hilgardia article, *Composition and Quality of Wines and Musts of California Grapes*, by M. A. Amerine and A. J. Winkler (in press). Those interested in more complete information on the merits and defects of specific varieties should write to the Division of Viticulture at Davis stating the varieties, the proposed region of planting, and the type and quality of wine desired.

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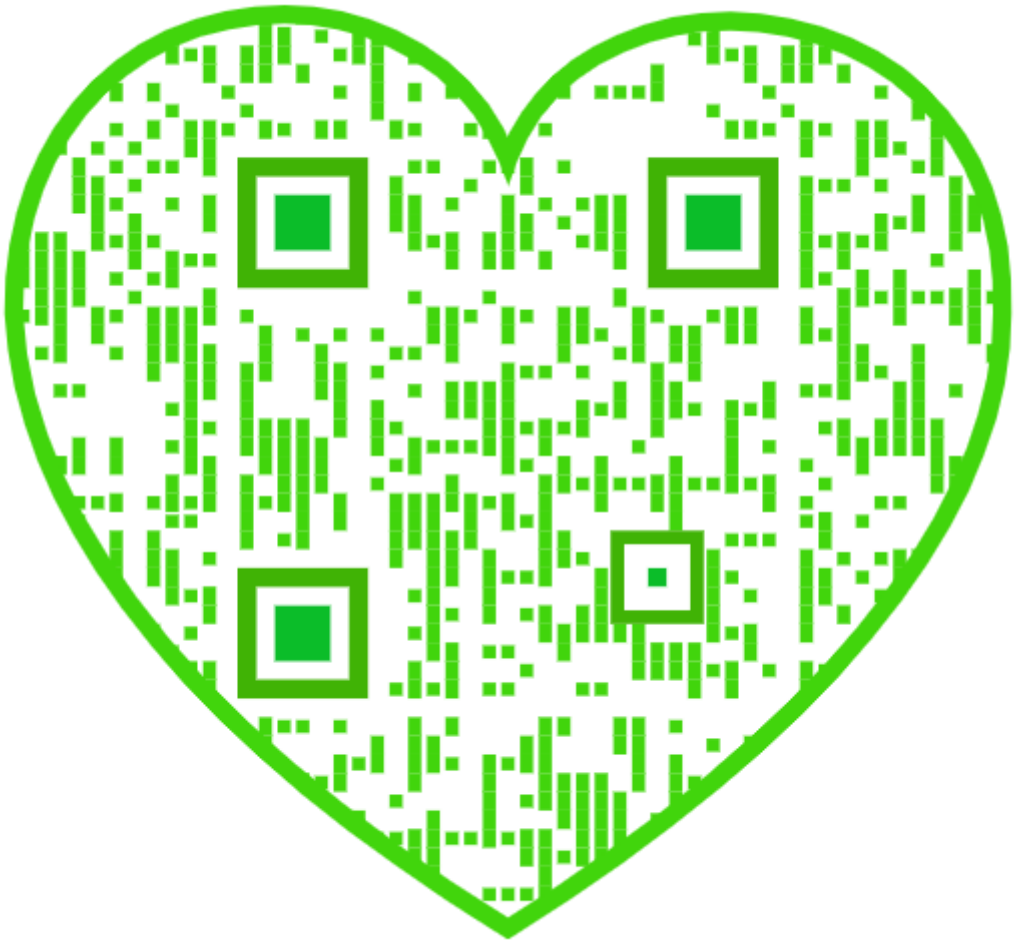
[4] For more complete data see Bulletin 651, *Commercial Production of Dessert Wines*, by M. A. Joslyn and M. A. Amerine. The percentage of wine grapes in the crush increased in 1942 because of the almost complete diversion of raisin grapes to drying.



fermentation, grape spirits must be added during or after the fermentation to give the required amount of alcohol. The more alcohol produced by fermentation, the smaller the amount required to arrest the fermentation. Musts of high Balling readings (over 24) are therefore preferable for making dessert wines. Such musts also yield wines with a higher extract content. The grapes should not, however, remain on the vines until they have become raisined and have lost their fruitiness. Since a sweet-sour taste is undesirable, the acid concentration should be only moderate—from 0.4 to 0.6 per cent in the finished wine is considered desirable. If the acidity is below 0.4 per cent, the wine is likely to taste flat and be unpalatable.

Fig. 1.—Vineyard on low coastal hills, region I. Note the redwood stumps. (Courtesy of the Wine Institute.)

The term "high-quality" as used here will describe wines whose character and composition favor the maturation of the wine in the wood or the bottle. A "standard" product is a sound wine that lacks the flavor, the composition, or both, to develop much character by aging. This is no condemnation of standard young wines, which have a very definite place in the industry. Dry white wines in particular can be sold early.

INFLUENCE OF ENVIRONMENTAL CONDITIONS

Regional Environment.—The environmental-varietal interrelation is complicated but important. Under cool conditions ripening proceeds slowly; the mature grapes retain a higher degree of acidity, have a lower pH; and red grapes possess much more coloring matter than those grown under warm conditions. These conditions favor the production of musts that are well suited for table wines. Under relatively warm ripening conditions, high sugar and moderate acidity are secured. Musts of such grapes are best suited for dessert wines. With some varieties the composition and flavor in certain regions is so superior that typical wines of high quality have been developed.

California has a wide range of climatic conditions. Utilizing the differences

in the temperature or more specifically the summation of heat as degree-days[5] above 50° F for the period April 1 to October 31, the grape-producing area of the state may be conveniently divided into five climatic regions. These regions, together with representative localities, are:

Region I (less than 2,500 degree-days):
Napa and Oakville in Napa County; Hollister and San Juan in San Benito County; Woodside in San Mateo County; Mission San Jose and Saratoga in Santa Clara County; Bonny Doon and Vinehill in Santa Cruz County; and Guerneville, Santa Rosa, and Sonoma in Sonoma County. Figure 1 shows a typical vineyard.)

Fig. 2.—Vineyard on hillside in region II. (Courtesy of the Wine Institute.)

Region II (2,501 to 3,000 degree-days):
Soledad in Monterey County; Rutherford, St. Helena, and Spring Mountain in Napa County; Santa Barbara in Santa Barbara County; Almaden, Evergreen, Guadalupe, and Los Gatos in Santa Clara County; and Glen Ellen in Sonoma County (fig. 2).

Region III (3,001 to 3,500 degree-days):
Livermore and Pleasanton in Alameda County; Calpella, Ukiah, and Hopland in Mendocino County; Calistoga in Napa County; Alpine in San Diego County; Templeton in San Luis Obispo County; Loma Prieta in Santa Clara County; and Alexander Valley, Asti, and Cloverdale in Sonoma County (fig. 3).

Region IV (3,501 to 4,000 degree-days):
Guasti in San Bernardino County; Escondido in San Diego County; Acampo, Escalon, Lockeford, Lodi, and Manteca in San Joaquin County; Cordelia in Solano County; Ceres, Hughson, and Vernalis in Stanislaus County; Ojai in Ventura County; and Davis in Yolo County (fig. 4).

Region V (4,001 or more degree-days):
Fresno and Sanger in Fresno County; Madera in Madera County; Arena and Livingston in Merced County; and Trocha in Tulare County (fig. 4).

[5] For example, if the mean temperature for a period of 5 days was 70° F, the summation would be (70°–50°) × 5 = 100 degree-days; and, if the mean temperature for June was 65°, the summation would be (65°–50°) × 30 = 450 degree-days.

Fig. 3.—Vineyard in the Livermore Valley, region III. Note the very coarse, gravelly texture of the soil. (Courtesy of the Wine Institute.)

Fig. 4.—A typical midsummer scene in a vineyard in regions IV and V. (Courtesy of the Wine Institute.)

Regions I and II should produce the best table wines; IV and V, the best dessert wines. When mature, only a few varieties will retain enough acidity to produce good table wines in regions IV and V, while only in a very hot season or in an exposed vineyard with an early variety will regions I and II produce grapes ideally suited for dessert wines.

Seasonal Conditions.—Although grapes reach maturity practically every year in most parts of California, their composition is not always the same. In a warm season the color content and titratable acidity are lower, and the pH is higher, than in a cool season. Such are the differences between certain years that a moderately acid variety, normally best suited for table wine, may sometimes become better adapted for dessert wine. This is particularly true in the regions of intermediate temperature; namely II, III, and IV.

CHOICE OF VARIETY

Whereas a few varieties can produce high-quality wine, many others because of unfavorable composition, neutral flavor, or susceptibility to rot or disease can never produce a fine wine. Fortunately there is a large demand for ordinary wines of sound character and low cost. If the grower chooses to produce this latter type, varieties that produce heavy crops should be planted. On the other hand, there is a limited but definite and growing demand for fine wines. Unfortunately, the varieties capable of producing such wine are only poor to moderate producers. The regional conditions suitable for fine wines also put a definite upper limit on the amount of crop that can be matured normally. Thus, planting heavy-producing varieties on poor soils of cool areas will not yield grapes capable of producing high-quality wines. Likewise, the planting of poor-producing varieties on fertile soil in warm regions is not a proper utilization of the land.

Composition of Musts.—As already indicated, varieties for table wines should attain a normal maturity and yet retain an acidity of at least 0.65 per cent or higher, whereas dessert-wine varieties should have at least 24° Balling and only a moderate acidity. The pH of grapes for table wines should, if possible, be below 3.3, while that of dessert wines may be as high as 4.0. The higher the pH, however, the greater the care necessary during fermentation to prevent spoilage by bacteria. The best red-wine grapes contain sufficient color and acidity, though when grown in too warm a region or season even those whose skins normally have sufficient coloring matter will produce poorly colored wines. The amount of color is particularly important for port varieties.

The grapes recommended should of course mature without undue rotting, sunburning, or raisining. The clusters should not be too tight, nor subject to shattering. For standard-quality wines, in order to reduce picking costs, large clusters are preferred. The skins should be thick enough to reach the winery in good condition. The stems and berries should be easily separated by a mechanical stemmer. Although ordinary wines can be prepared from varieties with a large berry, the better-flavored wines require a smaller berry size because of the more favorable surface-volume relation for extracting flavor and color from the skins.

Time of Maturation.—Early-ripening varieties are at a disadvantage in California: they mature in the warmest part of the growing season; and the ripening changes proceed too rapidly, so that low acid, excessive sugar, and sunburning ordinarily result. Varieties that mature in midseason are also considered better from the wine maker's point of view, since he can then crush them when fermentation temperatures are lower. Although late-ripening varieties have the advantage of lengthening the season, they run the risk of being spoiled by early rains.

RECOMMENDED VARIETIES[6]

Only varieties that yield the best product for their type—whether standard, quality red or white table, or red or white dessert wines—are listed in table 1. Varieties that cannot be unqualifiedly recommended are listed later.

Varieties for Region I.—Region I contains few fertile soils that are, or may well be, planted to vines. As a rule only hillside slopes of very moderate fertility are available for grapes. Heavy-bearing varieties should not be planted, since the region cannot produce them in competition with warmer and more fertile districts. In general, white varieties should be preferred to red. Recommended white varieties for high-quality dry table wines are White Riesling, Chardonnay, and Sauvignon blanc, the first two being the most desirable. Red Traminer, though useful, should be planted only in the very coolest locations for producing an aromatic wine, and is not ordinarily recommended. Sylvaner is not suited to this region, being oversusceptible to mildew in foggy locations. Varieties such as Burger and Folle blanche should be avoided because they will not ripen. Recommended red varieties for high-quality table wines are Cabernet Sauvignon and Pinot noir; for standard table wines, Gamay Beaujolais and Grenache.

Varieties for Region II.—Region II contains both valley-floor and hillside vineyards. The former should produce most of the standard red and white table wines of California. The less productive hillside vineyards, though unable to compete for a standard product, can yield fine wines. Recommended white varieties for high-quality dry table wines are Chardonnay, Pinot blanc, White Riesling, and Sauvignon blanc (the last-mentioned usually for natural sweet wine). Recommended white varieties for standard or for blended dry table wines are Semillon (for dry or natural sweet wine), Sylvaner, and Folle blanche. Red Veltliner, though useful, is less desirable and is not ordinarily recommended. The recommended red variety for high-quality table wines is Cabernet Sauvignon; for standard wines, Grenache, Petite Sirah, or Refosco. Also of possible utility for standard wines, but less desirable, are Mondeuse and Tannat.

Varieties for Region III.—The warm conditions of region III favor grapes of higher sugar content, without too much sunburning and too little acidity. Although most of the vineyards are on fairly flat land, some of the soils are rocky and of low productiveness. The better-quality natural sweet wines come from the latter soils. It is a mistake to hope to produce *dry* wines of the finest quality every year in this region, even on the less fertile soils, since the summation of heat is usually too great. Excellent natural sweet wines should, however, be secured; and, on the more fertile soils, good standard whites and reds. Trousseau, though not recommended because of the production cost, will produce very good red dessert wines. Recommended white varieties for natural sweet wines are Semillon, Sauvignon blanc, and Muscat Canelli (by itself); for standard wines, Pinot blanc, and French Colombard (Winkler, Wests Prolific). Also of possible utility for standard wines, but not ordinarily recommended, are Folle blanche and Peverella. Recommended red varieties

[6] The varieties listed are as grown under these names in the variety collection of the University Farm at Davis. Since not all have been identified with certainty, some of the names may be changed later. The current identification can be obtained from later publications of this station or from the Division of Viticulture, Davis.

TABLE 1

THE PRODUCTIVITY, TYPE OF WINE, REGION OF ADAPTATION, AND QUALITY OF THE PRODUCT OF THE RECOMMENDED VARIETIES

Variety	Productivity	Type of wine	Region of adaptation and quality of the product*				
			Region I	Region II	Region III	Region IV	Region V
White varieties							
Chardonnay	Low	Dry table	Excellent	Good	No?	No	No
Folle blanche	Moderate	Dry table	No	Standard	Standard?	No	No
French Colombard	Heavy	Dry table or blending	No	No?	Standard	Standard	No?
Malvasia bianca	Moderate	Sweet dessert	No	No	Good (sweet table)	Good	Good
Muscat Canelli	Low	Sweet dessert	No	No?	Good	Good	No
Orange Muscat	Heavy	Sweet dessert	No	No	No	Good	Good
Palomino	Heavy	Sherry	No	No	No	Good	Good
Pinot blanc	Low	Dry table	Good	Good	No	No	No
Sauvignon blanc	Low moderate	Dry or sweet table	Good	Good	Good (sweet table)	No	No
Semillon	High moderate	Sweet table	No	Standard	Good	No?	No
Sylvaner	Moderate	Dry table	No	Good	Standard	No	No
White Riesling	Low	Dry table	Good	Good	No	No	No
Red varieties							
Aleatico	Moderate	Sweet table	No	No	No	Standard	Standard
Barbera	High moderate	Dry table	No	No	Good	Good	No?
Cabernet Sauvignon	Low moderate	Dry table	Excellent	Good	Good?	No	No
Carignane	Heavy	Dry table	No	No	Standard	Standard-bulk	No
Gamay Beaujolais	Low moderate	Dry table	Good	Good	No	No	No
Grenache	Heavy	Dry table or dessert	Standard (pink table)	No?	No	Standard (dessert)	Good (dessert)
Mission	Heavy	Dessert	No	No	No?	Good	Good
Petite Sirah	High moderate	Dry table	No	Good	Standard	No	No
Pinot noir	Low	Dry table	Excellent	No?	No	No	No
Refosco	High moderate	Dry table	No	Good	Good	Standard	No
Salvador	High moderate	Color—only	No	No	No	Blending	Blending
Tinta Madeira	High moderate	Dessert	No	No	No?	Good	Good
Trousseau	Heavy	Dessert	No	No	Good	Good	Standard

* "No" indicates that the variety is not recommended for the region. "No?" indicates that the variety has been insufficiently tested for the region.

for standard table wines are Barbera, Carignane, and Refosco. Also possible but less desirable are Gros Manzenc and Sangioveto. The recommended red variety, if a red dessert wine is to be produced in this region, is Trousseau.

Varieties for Region IV.—The soils of region IV are usually fertile. Many vineyards are irrigated and can yield large crops. Certain low-producing vineyards of the foothills on the sides of the Sacramento and San Joaquin valleys fall, however, into this climatic zone. These should perhaps not be planted with grapes at all, since they cannot compete successfully with the fertile, irrigated valley soils. Although natural sweet wines are possible, in warm years the suitable grapes become sunburned and raisined. White dessert wines can be secured, however, as well as good red dessert wines. The standard white and red table wines from this district are fairly satisfactory if produced from high-acid varieties. For standard table wine the recommended white variety is the French Colombard (Winkler). For muscatels, recommended varieties include Malvasia bianca, Muscat Canelli, and Orange Muscat; for white dessert wines, Mission, Palomino, and Verdelho; for standard red table wine, Barbera. Also possible but less desirable are Grignolino (for pink wines) and Gros Manzenc. Recommended red varieties for bulk-quality table wines are Carignane and Refosco. Valdepenas, though useful, has certain deficiencies. Recommended red varieties for dessert wines are Tinta Madeira and Trousseau. The Tinta Cao is nearly as good and may sometimes be planted in place of Trousseau. Aleatico is recommended for red muscatel.

Varieties for Region V.—Region V, the hottest region where wine grapes are grown in the state, is also the most uniformly fertile. Except for a few vineyards near Redding, and some in the lower foothills, the district is entirely in the highly productive, irrigated interior valleys. Although bulk-quality red table wines can be produced from the varieties of very high acid, white table wines should not be attempted because of the warm storage conditions and the necessity for maintaining a high sulfur dioxide content in order to keep the color sufficiently light. Region IV vineyards are better adapted for producing the former quality; region III for the latter. Very good white and red dessert wines can be produced. Recommended varieties for muscatels are Malvasia bianca and Orange Muscat. The Muscat Canelli, though a possibility, grows weakly under these conditions, and the fruit often sunburns badly. Recommended for white dessert wines are Palomino, Mission, and Grenache. Best for red dessert wines are Trousseau (although preferably planted in III and IV) and Tinta Madeira. Tinta Cao is also practicable; and Black Malvoisie may be useful because of possible dual use as a shipping grape, but is not recommended. A desirable variety for special or blending wines is Salvador.

White Varieties.—The Chardonnay, although a vigorous grower, is only a moderate producer. Short canes should be employed in addition to the usual number of spurs during the early life of the vines. This variety has small clusters, ripens before midseason, and reaches the crusher in good condition. The must yield is below average. The wines are distinctive in quality, with a rich body and a normal acid content.

The Folle blanche produces well. The clusters are medium-sized and so compactly set with berries that they develop bunch rot in seasons of early rainfall. The grapes are easily crushed and yield a satisfactory amount of

juice of good acidity. The wines are fruity, slightly distinctive in flavor, and inclined to be tart. They make excellent average-quality table wines by themselves and have been very successful as a champagne stock.

The French Colombard is a vigorous, productive variety. Its medium-large clusters are well filled with oval, firm berries. It is primarily adapted to the conditions of region IV, where it retains high acidity and a moderate sugar content.

Malvasia bianca, Muscat Canelli, and Orange Muscat are considered to be best suited for making the muscatel type of wine in California. Malvasia bianca has a large cluster with fairly thick-skinned berries. Its wines are particularly fruity and rarely possess any raisin flavor. It is a fair producer. Muscat Canelli, on the other hand, is a low producer, only average in vigor. Since the fruit ripens early, raisining may occur. If the grapes are properly harvested, however, the wine is very fruity in character, and under favorable conditions is perhaps the best of the muscat types. Orange Muscat is both vigorous and productive, has medium-large clusters and firm, hard, thick-skinned berries. The flavor differs from that of the other muscat varieties, but is very pleasing in sweet dessert wines.

Palomino is vigorous and productive. Its clusters are large, with berries thick-skinned and moderately tough; and its fruit reaches the crusher in good condition. Its juice yield is below average. Its musts are of too low acidity for table wines, even in the cooler regions, but it is adapted to the production of soft sherry material of excellent quality.

Pinot blanc has a much more compact and somewhat heavier cluster than Chardonnay. It is liable to rot in damp weather. The musts of the cooler regions are well balanced when picking comes sufficiently early. The skins are high in tannin, and the grapes should be pressed immediately after crushing. The juice yield is good. The wines have a moderately distinctive character and are above average in quality.

Sauvignon blanc is a poor producer unless pruned long. (See Chardonnay.) It ripens early and has small clusters. The distinctive and aromatic flavor of its musts carries over into the wine. The juice yield is below average. When grown in the proper region Sauvignon blanc is suited for both dry and natural sweet table wines of high quality.

The Semillon produces well; its clusters are large and easily harvested, but the berries are rather tender-skinned. Its juice yield is good. Its wines have a recognizable flavor, most pleasant in natural sweet wine. Its table wines are less well balanced and have a rather rough flavor.

The Sylvaner produces moderate crops. It ripens early, and unless promptly harvested produces musts of very low acidity. Its wines, though less distinctive than those of the White Riesling, have definite varietal character and good quality. It should, however, be planted only in the cool regions, though not in the more humid parts of region I.

The White Riesling is of below-average productivity with small clusters and small berries. Its musts are somewhat better supplied with acidity than those of the Sylvaner. In the coolest locations its wines are of very good quality.

Red Varieties.—The Aleatico is an average producer. It ripens in midseason and, if the vines have sufficient leaf coverage, will reach a high degree

of sugar without raisining. Despite some deficiency in color, it is probably the most desirable red muscat-flavored variety now available. Although definitely muscat in character, its flavor is distinguishable from that of other muscat varieties.

Barbera, though vigorous, produces only moderately well. Since its musts have a high amount of acidity even in regions III and IV, it should not be planted in I or II. The wines are tart, moderately distinctive in aroma, of good color and tannin. When properly aged they are probably the best of those produced in regions III and IV.

The Cabernet Sauvignon is inclined, despite its vigor, to be a low producer. It should therefore be pruned with moderately long canes during the early life of the vine. It has fairly long clusters with small, tough-skinned berries, which ripen in midseason. Its wines are distinctive and easily recognizable; when properly aged they produce very high-quality red table wines.

The Carignane, a vigorous and productive variety, is susceptible to mildew and should not be planted in humid locations. The fruit, though firm, can be crushed without difficulty; and the juice yield is good. Its table wines are clean but not distinctive, and are only average in quality.

Gamay Beaujolais, barely average in productivity, ripens early and will raisin unless picked promptly. Although its musts are fairly well balanced, the wines are inclined to be deficient in color and acidity. The best Gamays, however, are very fruity and of good quality.

The Grenache is vigorous and productive. In the coolest locations its musts have enough acidity and color to be adapted for red or pink table wines. In region V, on the contrary, its musts are high in sugar and low in acidity and color; hence if pressed off the skins after crushing, they are white, and well adapted to the production of dessert wines of either the Angelica or the sherry type.

With the coming of the padres, the Mission, the first variety of *Vitis vinifera* origin, was planted in California. The vines are vigorous and productive; the clusters large, loosely set with medium-sized, round berries. Table wines of the Mission have been complete failures, largely through lack of acidity. The dessert wines, on the other hand, have been average or better—smooth, full-bodied, and fairly well balanced. Though the grapes are deficient in color for red dessert wines, the sherries and Angelicas are very good. Mission is adapted to regions IV and V.

The Petite Sirah produces above-average crops. Its clusters are compact and will rot after early rains. In the hot interior and in warm seasons elsewhere the fruit is very subject to raisining. In regions II and III it produces standard, heavy-bodied, moderately distinctive red table wines except in the hottest years. It should have a permanent place here, but here alone.

The vines of Pinot noir produce only moderate crops with long pruning. Its fruit matures very early. When grown in the cool areas and harvested at the proper time it produces wines of excellent aroma and flavor, fruity, soft, and balanced. This variety is adapted to region I.

The Refosco is moderately vigorous and productive. The clusters are large, loosely set with firm berries that resist handling injuries and unfavorable weather. In regions II and III it produces standard wines of moderate distinctiveness and excellent color. It does well on the fertile, flat soils of regions

II and III. In IV it produces a better table wine than Carignane, but is less productive.

The Salvador, a hybrid of *Vitis rupestris* × *V. vinifera,* is interesting for its intense color. Its vines, though low in vigor, are very productive. The clusters are small. The flavor derived from its American parent is objectionable in its wines. Its intense color, however, can be used in moderation without noticeably injuring the wines into which it is blended. Though the color is most intense in cool regions, this variety may be grown for its color in all regions.

The Tinta Madeira vines are vigorous and productive. The clusters are medium-sized and well filled. This is strictly a dessert-wine variety. Its red dessert wines are well colored, smooth, flavorsome, and well balanced. It is recommended for regions IV and V.

The Trousseau is very vigorous and productive with spur pruning. Its clusters are medium-sized and compact. The fruit ripens early and is rather subject to raisining. This variety is not suitable for dry table-wine production. Its red dessert wines, though deficient in color, are outstanding for mellowness, flavor, balance, and other properties. The variety is adapted to regions III, IV and V.

VARIETIES WITH LIMITED RECOMMENDATION

A number of varieties cannot be recommended without reservation. The reasons differ from variety to variety. The most common objection is simply that other varieties excel them under most conditions for their particular type and quality of wine. Under particular conditions, some of these grapes have given good results in California and abroad. The mere fact that a variety can produce good wine does not, however, prove that others will not excel it if adequately tested. Furthermore, some varieties have succeeded under special, restricted conditions that can seldom be duplicated satisfactorily. This is true of certain varieties that have found a place in local and minor regions of European viticulture over a long period. The taste created for such varieties as Nebbiolo and Chenin blanc will insure their continued propagation. But to plant them here and expect their wines to compete with better ones is risky. Perhaps, as the California industry expands and as greater attention is paid to particular flavors, some additional varieties may find a local but permanent place.

Other grapes listed here have special qualities of production, possible dual utilization for wine and shipping, disease resistance, period of ripening, and the like. Where one or more of these factors must be specially considered, some variety in this group may prove useful.

Because of another factor—the present plantings—Zinfandel is included in this group. It has a permanent place in California for a distinctive type of wine. Since, however, it is already the most extensively planted red-wine grape, its new plantings will seldom be as profitable as those of the varieties listed previously. *All the varieties listed in table 2 have one or more defects, and one should plant them only after considering their handicaps.*

White Varieties.—These include blending varieties, Burger and Servant; varieties having a Muscat flavor, Muscadelle, Muscat of Alexandria, and Red Traminer; table or natural sweet wine varieties, Aligote, Chenin blanc, Gray Riesling, Peverella, Red Veltliner, and Vernaccia Sarda; and dessert-wine

TABLE 2

Productivity, Type of Wine, Region of Adaptation, and Probable Quality of the Product of the Recommended Varieties

Variety	Productivity	Type of wine	Adaptation to region and probable quality of the product*				
			Region I	Region II	Region III	Region IV	Region V
White varieties							
Aligote	Moderate	Dry table	No	Good	Standard	No	No
Burger	Heavy	Dry blending	No	Standard	Standard	No	No
Chenin blanc	High moderate	Dry or sweet table	No	Standard	Standard	No	No
Gray Riesling	Heavy	Dry table or dessert	Standard dry table	No?	No	No	Good dessert
Inzolia	Heavy	Dessert	No	No	No	Standard	Standard
Muscadelle	High moderate	Sweet table	No	No	Good	No	No
Muscat of Alexandria	Heavy	Dessert	No	No	No	No?	Standard
Peverella	Heavy	Dry table	No	No	Good	Good	No
Red Traminer	Low	Dry table	Good	No?	No	No	No
Red Veltliner	Moderate	Dry table	No	Standard	No	No	No
Vernaccia Sarda	Heavy	Dry table	No	No	No	Standard	No?
Red varieties							
Alicante Ganzin	Moderate	Color and dry table	No	No	No	Standard	No?
Aramon	Very heavy	Pink, dry table	No	Standard	Standard	No	No
Beclan	Low	Dry table	Good	Standard	No	No	No
Black Malvoisie	Heavy	Dessert	No	No	No	Standard	Standard
Bolgnino	High moderate	Dry table	No	No	Standard	Standard	No
Charbono	High moderate	Dry table	Standard	No?	No	No	No
Fresia	Moderate	Dry table	No	No	Good	Good	No
Grignolino	Moderate	Dry table	No	No	No	Good	No
Gros Manzenc	Moderate	Dry table	No	No	Good	Good	No
Lagrain	Heavy	Blending or dry table	No	No	No	Standard	No
Limberger	Moderate	Dry table	Standard	Standard	No	No	No
Mammolo Toscano	Moderate	Dry table	No	No	No	No	Standard
Mondeuse	Heavy	Dry table	No	Standard	No?	No	No
Muscat Hamburg	High moderate	Dessert or sweet table	No	No	No	No?	Good
Nebbiolo	Moderate	Dry table	No	No	Good	Standard	No
Negrera Gattinara	Moderate	Dry table	No	No	Standard	No?	No
Raboso Piave	Moderate	Dry table	No	No	No	Standard	Standard
Saint Macaire	Moderate	Dry table	No	No	No	Standard	Standard
Sangioveto	Moderate	Dry table	No	No	Good	Good	No
Tannat	Moderate	Dry table	No	Good	Standard	No	No
Tinta Cao	Moderate	Dessert	No	No	No	Good	Good
Valdepenas	Heavy	Dry table or dessert	No	No	No	Standard—bulk	No
Zinfandel	High moderate	Dry table	No	Standard	Standard	Standard—bulk	No

* "No" indicates that the variety is not recommended for the region. "No?" indicates that the variety is insufficiently tested for the region.

varieties, Inzolia and Verdelho. These have a wide range of climatic adaptation, some being suited to the cooler regions and others to the warmer.

The Burger is widely planted in California, largely because of its productivity. Its clusters are large, compact, and very subject to handling injuries and to damage by rain. The fruit lacks acid; and its wines, used straight, are deficient in flavor and character. Their neutrality and plainness has given them recognition for blending to reduce excesses in other wines. In the cooler regions the Burger is surpassed even for blending by Servant, which is likewise neutral, but which possesses a more favorable acidity. Neither variety is adapted to the interior valleys; here the French Colombard may merit consideration.

The Muscat of Alexandria is pre-eminently a raisin grape. Because it tends to raisin on the vines, and because its flavor is not pronounced until the fruit is fully ripe, it does not readily produce quality wines in many areas. With great care in harvesting, good dessert wines may be obtained. The flavor is not equal to that of several of the muscat varieties recommended previously.

Of the other white varieties with a limited recommendation, the Aligote, Red Traminer, and Red Veltliner are deficient in acid for producing quality wines in most areas. In localities where their musts are well balanced they will merit planting. The Peverella and Vernaccia Sarda are fairly well supplied with acid and yield mildly distinctive wines, but they have been insufficiently tested. The Gray Riesling, Inzolia bianca, and Verdelho are deficient in acid for dry table wines, and not productive enough to compete with the highly productive dessert-wine varieties, except under special conditions. The Chenin blanc and Muscadelle show more than average promise for sweet table wines.

Red Varieties.—Most of the varieties listed here are suitable for red table wines in one or more regions. All, however, have one or more defects that limit their usefulness. Included are Aramon, Beclan, Bolgnino, Charbono, Fresia, Grignolino, Gros Manzenc, Lagrain, Mammolo Toscano, Meunier, Mondeuse, Nebbiolo, Negrera Gattinara, Raboso Piave, Saint Macaire, Tinta Cao, Valdepenas, and Zinfandel. Also listed is a variety that produces blending wines, Alicante Ganzin; two dessert-wine varieties, Black Malvoisie and Tinta Cao; and a muscat-flavored variety, Muscat Hamburg.

Though the Aramon has never produced a quality wine, its wines in the cooler regions are distinctly fruity, mature rapidly, and are markedly free of vinification difficulties. Except for pink wines the variety is deficient in color. It is a tremendous producer.

The Black Malvoisie produces only standard-quality red dessert wines but may be used, in addition, as a table grape. Its clusters and berries are very large and attractive. It will not produce dry table wines.

The Grignolino is a moderate producer. Its clusters are large and handle well. Its wine has a distinctly varietal aroma and flavor, appealing strongly to those who like it, but not meeting with general favor. It is high in tannin but only light orange-red in color.

The Gros Manzenc is a moderate producer with long spur pruning. Its medium-sized clusters handle well. Its wines are distinctive, fresh to tart, well balanced, and well colored. Perhaps it should displace some of the Carignane, Zinfandel, or Petite Sirah in certain localities of regions III and IV.

The Mondeuse, a heavy producer, tends to mature its fruit poorly. Though of average acid content and distinct aroma, its wines have been only of standard quality in the coastal areas. They have tended to be somewhat coarse and lacking in finish, better suited for blending than for aging straight.

The Saint Macaire is only moderately productive. Its fruit is not covered sufficiently to prevent sunburning in warm seasons. The wines are heavy and full-bodied, with intense color. They require long aging. For blending, in regions IV and V, their acid, color, tannin, and body may have value.

The vines of Sangioveto are vigorous, but only moderately productive. The wines are well balanced as regards acidity, body, tannin, and color, and are distinctive in aroma and flavor. This variety should replace some of the bulk sorts in certain localities in regions III and IV.

The Tannat is vigorous and moderately productive, with medium-large clusters that handle well. In the coolest areas its wines have considerable character, are delicate and balanced. Under somewhat warmer conditions, however, they tend to be coarse and tannic, and to require too much time to mature in the wood.

The Valdepenas is both vigorous and productive. Its clusters are large and resist handling injuries. Its musts have regularly been too low in acid to produce balanced dry table wines. In the cooler areas where the acidity of the fruit is higher, the variety is subject to mildew and bunch rot. Its dessert wines are generally better balanced, but they tend to be astringent.

The Zinfandel is very widely planted in California. It ships fairly well, and its distinct varietal aroma and flavor are passed on to the wine. When sound, uniformly well-matured fruit is used, the Zinfandel produces a well-balanced, fruity, distinctive wine of average quality. In region IV it has also yielded standard red dessert wines. The variety possesses, however, the defect of ripening its fruit unevenly; some berries may be raisining before others are more than changing from pink to red. Because of its compact clusters it is also very subject to bunch rot during humid periods or after rains.

Of the other red varieties of limited recommendation, Beclan and Charbono can justify places for themselves only in the cooler areas where their resistance to mildew offsets their lack of vigor or their other defects. Bolgnino, Fresia, Nebbiolo, Mammolo Toscano, Negrera Gattinara, and Raboso Piave produce well-balanced wine of greater or less distinctive aroma and flavor and above-average quality; but they are deficient in productivity or in some property of the wine, such as color and finish. In the interior the Lagrain may have some value because of its intense and stable color, and in coastal counties the early-maturing Limberger might be used to lengthen the harvesting season. Muscat Hamburg shows promise for sweet table wines. Although Tinta Cao is only moderately productive, its fruit withstands unfavorable weather conditions much better than the other red dessert-wine varieties. In quality its wines are standard or better.

VARIETIES NOT RECOMMENDED

Many varieties are so devoid of merit that they cannot be recommended anywhere in California under present conditions. The wine grapes listed below fail for various reasons to qualify as varieties recommended for planting. The most common objections are lack of sufficient sugar, acid, or both, low

production, and susceptibility to rot or diseases. Some varieties listed here have flavor, but in quality or production are so inferior to other closely related varieties that they need not be considered.

White varieties not recommended include Bombino bianca, Clairette blanche, Feher Szagos, Green Hungarian, Hibron, Hungarian Millenium, Kleinberger, Malmsey, Marsanne, Mathiasz y-ne, Mourisco branco, Muscat Pantellana, Muscat Saint Laurent, Nasa Veltliner, Nicolas Horthy, Palaverga, Pavai, Roussette, Saint Emilion, Sauvignon vert, Selection Carriere, Steinschiller, Terret, Vermentino Favorita, and Vernaccia bianca.

Red varieties not recommended include Alicante Bouschet, Antibo, Aspiran noir, Black Hamburg, Black Prince (Rose of Peru), Blaue Elbe, Bonarda, Chauche noir, Chenin noir, Coristano, Criolla Mesa, Criolla Vino, Croetto Moretto, Dolcetto, Early Burgundy, Grand noir, Grec rouge, Grosse blaue, Kadarka, Koptcha, Lambrusche Langhre, Lenoir, Macaroli, Marzemino, Mataro, Meunier, Negro Amaro, Neiretta, Pagadebito, Petit Bouschet, Petite Verdot, Pfeffer, Picpoule noir, Pinot Pernand, Pinot Saint George, and Tinta amarella.

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